PART 4: SECTION 2

CHAPTER 2

AIMING EQUIPMENT

Types of Sights

1. From the study of the general problems involved in aiming the different types of missiles, it will be appreciated that the instant of release is established when certain factors affecting aircraft, missile, and target performance, are in phase. These factors are usually interrelated as angles in the horizontal and vertical planes. The accuracy of the unaided human eye in estimating these angles is insufficient to satisfy the requirements of the aiming problem. Some means is therefore required to assist in the measurement, as well as the determination, of that point in space at which the missile must be launched to hit the target. The mechanical sights provided for this may be considered in three categories :—

(*a*) Vector sights.

(*b*) Angular-velocity sights.

(*c*) Tachometric sights.

Vector Sights

2. There are gun, rocket, and bombsights in this category. They are simply aids to measurement of the deflection angle or bombing angle. The appropriate vector measurements for speed, height (or range), target movement, and wind velocity, are set on the sight, and the required deflection angle or bombing angle is resolved as the resultant of the vectors. Examples of the vector sight are :—

(*a*) The reflector gunsight (fixed ring), where the ring of the sight subtends a given angle at the eye, which is the required deflection angle for a chosen target speed relevant to the attacking aircraft. Different relevant target speeds may be estimated and allowances made in terms of radii of the ring. An allowance for missile ballistics is preset on the sight.

(*b*) The vector bombsight, where the vectors are set manually or by instruments (height, airspeed, and direction of attack) and the correct bombing angle is resolved and the release line of sight presented by optical (graticule) or mechanical means. Allowance for missile ballistics is made by selecting the appropriate terminal velocity setting.

3. To aim the missile the aircraft is manœuvred until the graticule of the sight is offset in relation to the target by the predetermined angle of deflection or, in the case of bombing, until the line of sight to the target coincides with that presented on the bombsight.

Angular-Velocity Sights

4. This category contains bomb, gun, and rocket sights. Each sight differs in its use of the basic principle of this aiming method, though all depend on the correct assessment of the angular velocity of the line of sight to the target, relative to the attacking aircraft.

5. In the bombsight, by setting height and ground speed the appropriate angular velocity of the line of sight is fixed. The aircraft is tracked towards the target, and the release point is determined when the angular velocity of the line of sight to the target coincides with that of the bombsight.

6. In the gun and rocket sights, the angular velocity of the line of sight to the target is measured by following, or tracking it accurately with the centre dot of a gyroscopically controlled graticule while measuring the range to the target by visual or radar means. The correct deflection angle is determined by the sight mechanism as long as it is being fed with the correct range and angular velocity. When the graticule is correctly positioned on the target, and the range is within that of the armament carried, the missiles may be launched.

Tachometric Sights

7. The more accurate types of high-level bombsights are usually to be found in this category. Settings for height, airspeed, groundspeed, drift angle, and bomb ballistics, are made by the bomb aimer. These set up a line of sight to the target which is about 40 seconds of time ahead of the line of sight at the time of release. The aircraft is then flown to bring the graticule on to the target and the sight is switched on. This causes a motor to rotate the line of sight at a speed dependent on the aircraft height and the groundspeed. The bomb aimer keeps the sight

graticule on the target throughout the bombing run by using controls to adjust range and line, and thus determine the correct drift, ground-speed, and bombing angle. When the sighting angle and correct bombing angle are equal, the bomb load, previously selected and fused, is released automatically, thus eliminating the human error present in all forms of manual release.

Limitations of Sights

8. Sights are designed to satisfy certain conditions : some are limited in operation over certain ranges, heights, or speeds ; those which include gyro stabilization may be upset by violent manœuvres and so limit the tactical freedom of the aircraft. Deviations in missile launching caused by slip or skid have not been successfully overcome by predicting sights. In all sights there is some information which cannot be automatically computed but depends on the skill of the user for interpretation. Smooth and consistent handling of the aircraft is necessary to give computing mechanisms time to settle down, as no means are incorporated in the sights for averaging out excessive manœuvres and resultant over-corrections.

Radar Aiming Equipments

9. Radar aiming equipments may be considered under three classifications :—

(*a*) Primary radar—airborne equipment.

(*b*) Primary radar—ground equipment.

(*c*) Secondary radar—ground and airborne equipment.

Primary Radar—Airborne Equipment

10. Under this classification there are bomb, rocket, and gun aiming equipments. The bomb-aiming equipment provides a picture of the ground on a radar screen in the aircraft, enabling a bombing run to be made by computing the forward travel of the bomb load to be released and guiding the aircraft on to a track which passes over the target. When at a correct distance from the target, as shown by the radar screen bombing circle which is set to correspond with the computed forward travel of the bomb load, the bombs are released.

11. The rocket and gun aiming equipments present a radar picture of the target in terms of range, elevation, and azimuth from the attacking aircraft. By manœuvring the aircraft until the elevation and azimuth presentations are centred, and ensuring that the target is within range of the armament carried, the missiles may be launched.

Primary Radar—Ground Equipment

12. This classification includes both bomber and fighter directing equipments.

13. The bomber-directing equipment presents an accurate radar picture to a ground controller of the position of attacking bomber aircraft in relation to the ground target. The ground controller is thus able to guide the aircraft, on a predetermined heading and height, to the correct point in space relative to the target for the release of the bomb load, and to cause the bombs to be released.

14. The fighter-directing equipment presents a radar picture to a ground controller of the target and attacking aircraft, thus enabling the controller to guide the attacking aircraft into a position from which an attack may be delivered, using either airborne primary radar or a visual means of aiming.

Secondary Radar—Ground and Airborne Equipment

15. The equipments under this classification consist of ground radar sets with responders in the aircraft, or of aircraft radar sets with responders on the ground, and are used for bombing. These equipments enable an aircraft to be positioned accurately in relation to the ground and consequently to be flown to the correct release point for the attack without visual reference to the target.

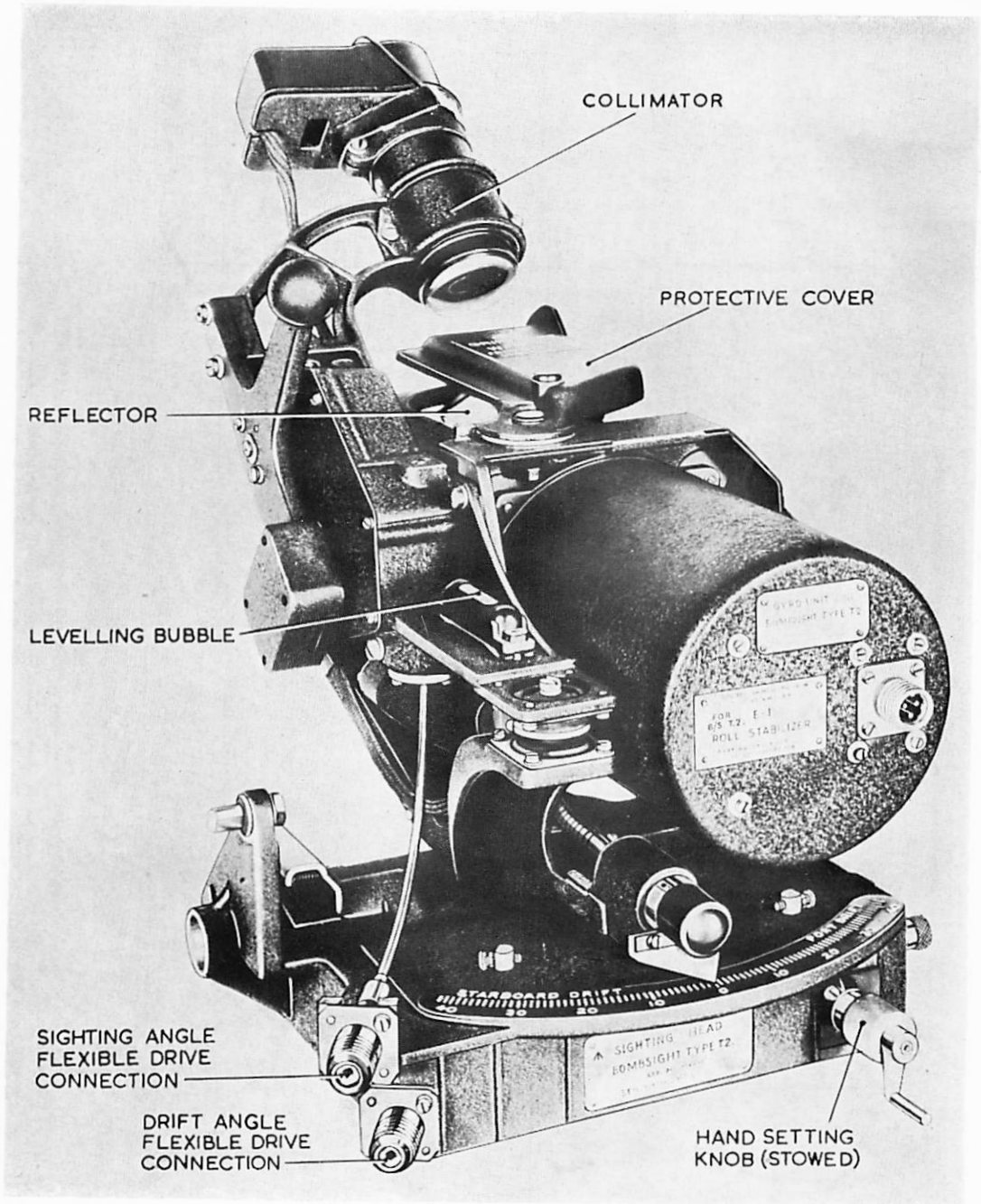

Fig. 1. (*a*)
T.2 Bombsight Sighting Head.

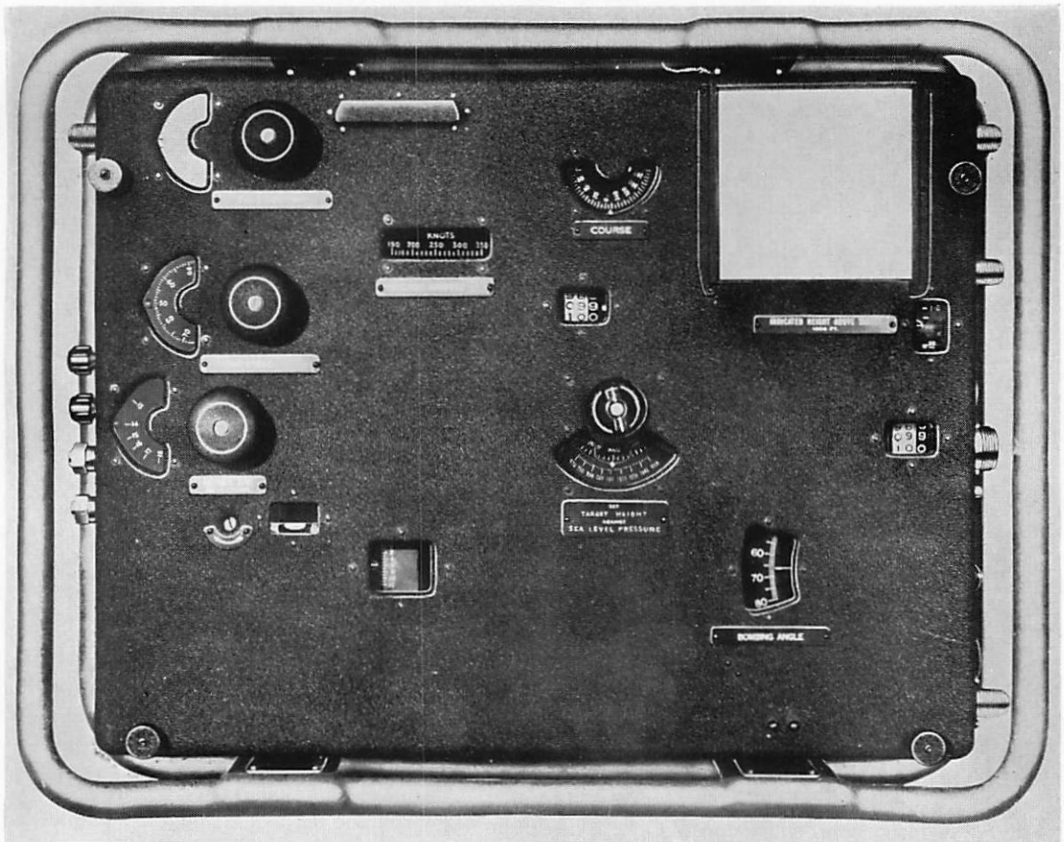

Fig. 1. (*b*)
T.2 Computer.

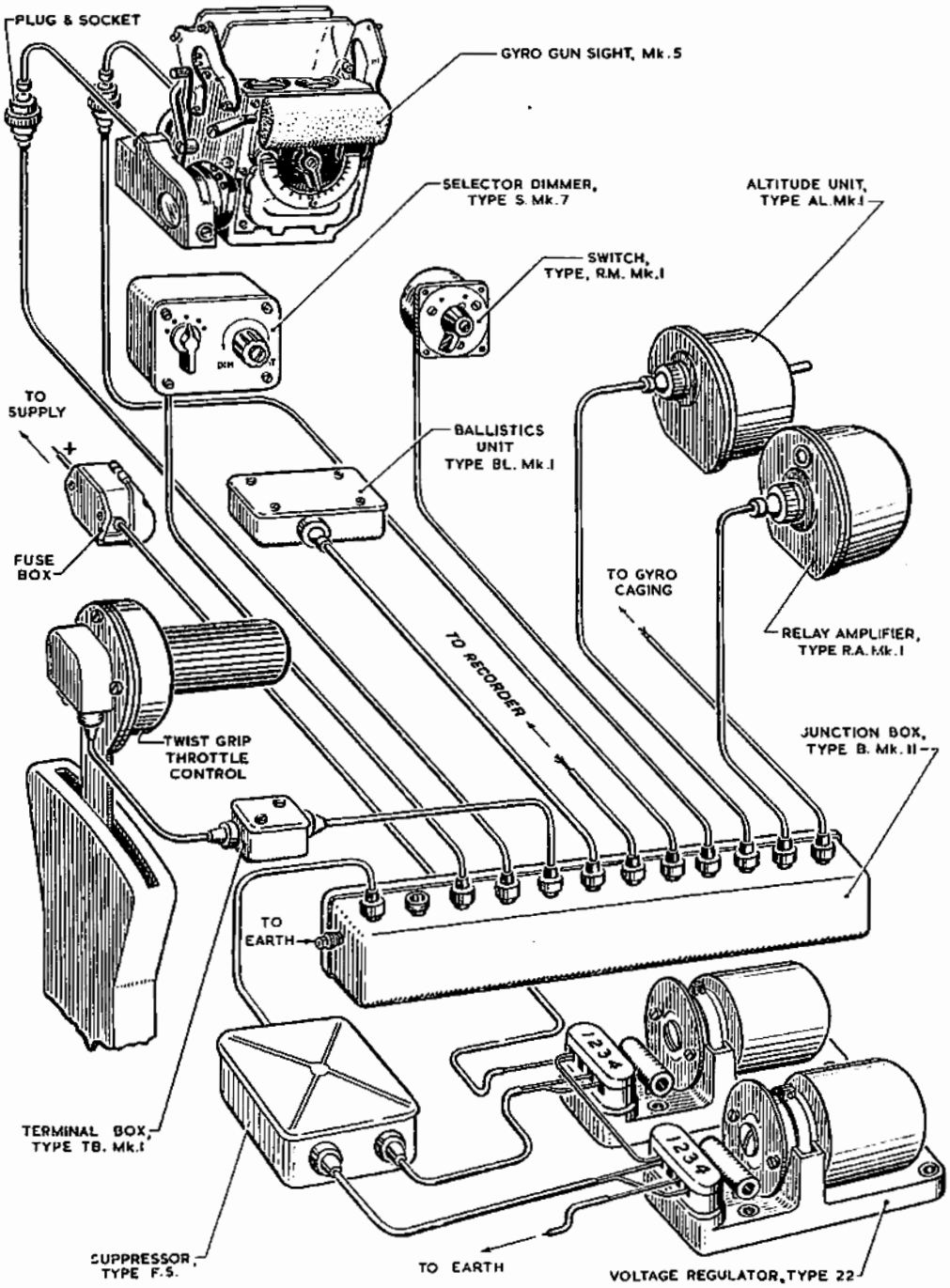

Fig. 2. A Typical Angular Velocity Sight—the Gyro Gun Sight (G.G.S.), Mk. 5.

Radar ranging can be used with this sight.

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